

Does lower indoor temperature reduce the risk of intimate partner violence (IPV)?

Experimental evidence from rural Burkina Faso

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Overview

1. Background to the cool roof project
2. Intimate Partner Violence (IPV)
3. Empirical strategy
4. Results
5. Summary and concluding remarks

Motivation

- The Climate crisis is worsening and adversely affecting people's food, health, and livelihoods.
- Problem is worse in low-income countries [Diffenbaugh & Burke, 2019].
[▶ Show](#)
- Within LDCs, those with poor housing conditions are disproportionately affected [IPCC, 2014].
 - Advances in housing technologies has proved effective [Singh et.al., 2010].
 - Cool roofs are cheap & effective (3-4°C lower indoor temperature) [Taleb, 2014]

The cool roof intervention

- Heidelberg Institute of Global Health (HIGH) and Nouna Health Research Centre (CRSN).
- Implemented in Nouna, Burkina Faso.
 - Surface temperature over West Africa and the Sahel increased by 0.5°C–0.8°C between 1970 and 2010 [Niang et al. 2014].
- A household-(cRCT) to study the effect of cool roofs on wide range of health & economic outcomes.

▶ Show

Design & Data

- Population: Nouna Health and Demographic Surveillance System (HDSS).
- The sample design follows a cRCT
 - ▶ Show
- 600 houses (300 control & 300 treated) are covered; in each HH a husband & wife are interviewed.
- No baseline data
- Data collection:
 - Climate vars (temp, humidity): every 15mins
 - Selected outcomes (HR, activity): continuous
 - Other vars (e.g.heat exposure): monthly visits
 - Behavioral vars (e.g. affect, aggression, IPV): seasonally
- 22 rounds of data from Aug 21 till Jun 23.

Validity of the intervention: Randomization

Table: Balance test by treatment status (Mean/(SE))

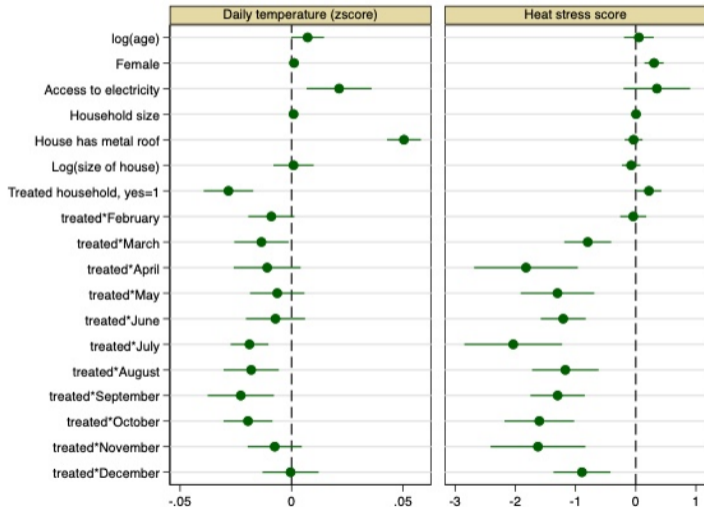
Variable	(1) Total	(2) Control	(3) Treated	(2)-(3) Pairwise t-test
age	42.98 (0.37)	43.25 (0.54)	42.71 (0.52)	0.536
Female	0.50 (0.02)	0.51 (0.02)	0.50 (0.02)	0.013
Household size	6.86 (0.12)	6.93 (0.17)	6.78 (0.16)	0.157
# of residents	3.98 (0.05)	4.00 (0.07)	3.96 (0.07)	0.042
Area of residence (sqm)	33.06 (4.79)	33.69 (8.02)	32.44 (5.24)	1.252
Access to electricity	0.04 (0.01)	0.02 (0.01)	0.05 (0.01)	-0.025**
House has cooling/heating appliances	0.01 (0.00)	0.01 (0.00)	0.01 (0.00)	-0.002
Observations	1,190	596	594	1,190

Validity/effectiveness of the intervention

Table: Comparison of thermal comfort by treatment status by season (Mean/(SE))

Variable	Cold Season		Warm Season	
	Control mean	Mean difference	Control mean	Mean difference
Excessive sweating	0.00 (0.00)	-0.004	0.19 (0.02)	-0.147***
Thirsty?	0.61 (0.02)	0.010	0.95 (0.01)	-0.129***
Muscle/Heat cramps	0.00 (0.00)	0.002	0.15 (0.02)	-0.106***
Tiredness/weakness	0.02 (0.01)	-0.002	0.23 (0.02)	-0.103***
Dizziness?	0.00 (0.00)	0.007	0.02 (0.01)	-0.004
Headaches?	0.05 (0.01)	0.008	0.12 (0.01)	-0.008
Nausea or vomiting?	0.00 (0.00)	0.002	0.01 (0.00)	-0.005
Heat stress is bad, yes=1	0.18 (0.02)	0.001	0.33 (0.02)	-0.074***
Heat strain score index (HSSI)	1.91 (0.11)	0.084	9.88 (0.10)	-1.914***
Observations	571	1,147	559	1,124

Validity/effectiveness of the intervention



Intimate Partner Violence (IPV)

Heat and IPV - Challenges in estimation

- Why do we expect any relationship?
 - Productivity pathway: declines during heat waves and makes conflict more profitable
 - Aggression, stress & arousal are higher during hot temperatures [Anderson, 2001; Hsiang et al. 2011]
- Challenge: social desirability, fear, shame
 - Underreporting of IPV when a direct questioning method is used [Gibson et al. 2022]
 - List randomization improves estimates [Peterman et al. 2018]

IPV questionnaire – a list randomization design

List 1	List 2
<ol style="list-style-type: none">1. In the last 3 months, I have taken care of a sick relative who is unable to care for themselves2. In the last 3 months, I used contraceptives to reduce the incidence of pregnancies3. <i>In the last 3 months, I have been slapped, beaten or physically harmed by my husband/partner</i>4. In the last 3 months, I ran out of the money I needed for basic things more often than before5. In the last 3 months, I attended the wedding celebration of a friend/relative	<ol style="list-style-type: none">1. In the last 3 months, I have taken care of a sick relative who is unable to care for themselves2. In the last 3 months, I used contraceptives to reduce the incidence of pregnancies3. In the last 3 months, I ran out of the money I needed for basic things more often than before4. In the last 3 months, I attended the wedding celebration of a friend/relative
# of agreed statements: IPV1	# of agreed statements: IPV0

Prevalence of IPV=IPV1-IPV0

Double-list randomization design

Respondents assigned to Group 1	Respondents assigned to Group 2
List A	List A
<ol style="list-style-type: none"> 1. In the last 3 months, I have taken care of a sick relative who is unable to care for themselves 2. In the last 3 months, I used contraceptives to reduce the incidence of pregnancies 3. <i>In the last 3 months, I have been slapped, beaten or physically harmed by my husband/partner</i> 4. In the last 3 months, I ran out of the money I needed for basic things more often than before 5. In the last 3 months, I attended the wedding celebration of a friend/relative 	<ol style="list-style-type: none"> 1. In the last 3 months, I have taken care of a sick relative who is unable to care for themselves 2. In the last 3 months, I used contraceptives to reduce the incidence of pregnancies 3. In the last 3 months, I ran out of the money I needed for basic things more often than before 4. In the last 3 months, I attended the wedding celebration of a friend/relative
# of agreed statements: IPV1-list A	# of agreed statements: IPV0-list A
List B	List B
<ol style="list-style-type: none"> 1. In the last 3 months, I spent much more time working than I normally would have 2. In the last 3 months, I thought about having more children 3. In the last 3 months, there were more arguments in our household than there were before. 4. In the last 3 months, I felt much closer to my family than I did before 	<ol style="list-style-type: none"> 1. In the last 3 months, I spent much more time working than I normally would have 2. In the last 3 months, I thought about having more children 3. <i>In the last 3 months, I have been slapped, beaten or physical harmed by my husband/partner</i> 4. In the last 3 months, there were more arguments in our household than there were before 5. In the last 3 months, I felt much closer to my family than I did before
# of agreed statements: IPV0-list B	# of agreed statements: IPV1-list B

Descriptive stats. – Balance test

Table: Balance test by group assignment

Variable	(1) Total	(2) Group 1	(3) Group 2	(2)-(3) Mean difference
age	40.17 (0.37)	40.32 (0.53)	40.01 (0.51)	0.31
Household size	6.80 (0.11)	6.84 (0.16)	6.76 (0.15)	0.08
Treated household	0.50 (0.02)	0.52 (0.02)	0.49 (0.02)	0.03
House has metal roof	0.51 (0.02)	0.54 (0.02)	0.48 (0.02)	0.057*
Access to electricity	0.02 (0.00)	0.02 (0.01)	0.02 (0.01)	0.01
Respondent has privacy	0.58 (0.02)	0.60 (0.02)	0.57 (0.02)	0.04
Log(size of house)	3.16 (0.01)	3.15 (0.02)	3.17 (0.02)	(0.01)
	1,154	574	580	1,154

Descriptive Stats. – IPV Prevalence

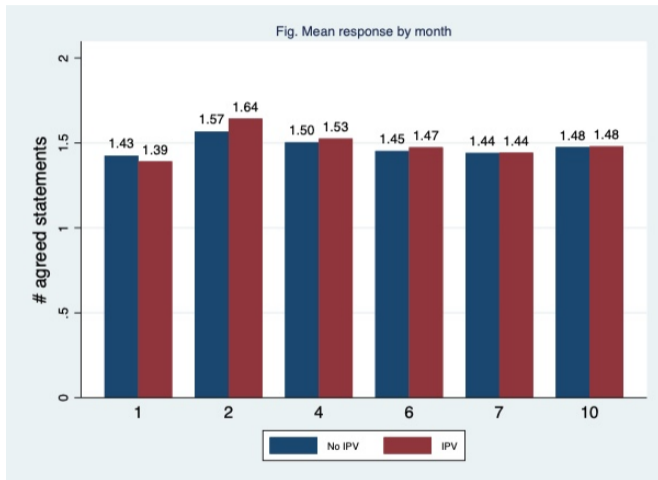


Figure: Prevalence of IPV

Estimation Strategy

- The basic model (Prevalence of IPV):

$$Y_{it} = \alpha + \beta_1 IPV_{it} + \epsilon_{it} \quad (1)$$

β_1 - is the diff. in of responses by IPV group;

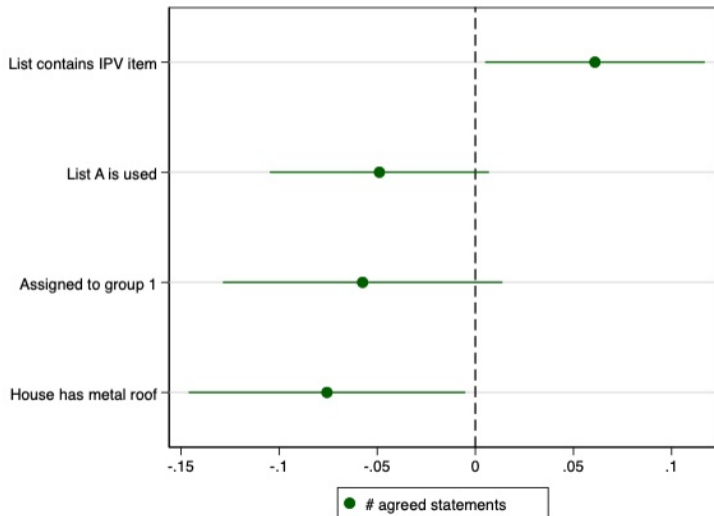
- The effect of cool roof on the prevalence of IPV:

$$Y_{it} = \alpha + \beta_1 IPV_{it} + \beta_2 T_i + \beta_3 IPV_{it} * T_i + \epsilon_{it} \quad (2)$$

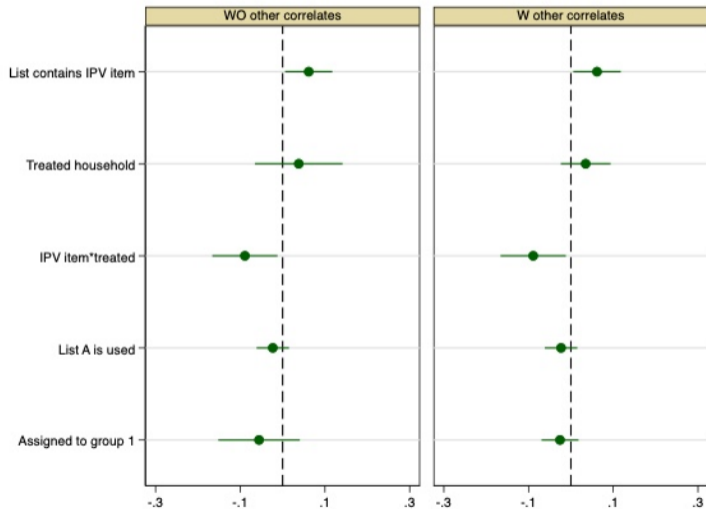
β_3 : the diff. in IPV prevalence rate between control and treated groups.

- IV approach (ITT assign for temperature)

IPV is prevalent in the study location



Prevalence of IPV is lower for treated groups



IV est. - First stage reg.

Table : First stage regression

Variables	Mean temp.	Max temp.	Temp. Zscore
Treated household	-0.913*** (0.050)	-1.292*** (0.098)	-0.029*** (0.002)
Household & location char.	yes	yes	yes
Constant	27.594*** (0.330)	32.106*** (0.477)	0.874*** (0.010)
Observations	7,582	7,582	7,582
R2	0.780	0.599	0.780
Adjusted R2	0.780	0.597	0.780
IV DIAGNOSTICS			
Kleibergen-Paap LM statistic	145.42	84.21	145.42
Kleibergen-Paap p-value	0.000	0.000	0.000
Cragg-Donald test	89.58	124.02	89.58
Hansen-J test	0.05	0.154	0.05
Hansen-J p-value	0.822	0.695	0.822

Note: .01 - ***; .05 - **; .1 - *;

High indoor temp. increases IPV incidence

Table 2: Effect of temperature on IPV, IV method

Variables	Mean temp.	Max temp.	Temp. Zscore
Daily temperature	-0.029 (0.022)	-0.015 (0.016)	-0.930 (0.687)
List contains IPV item	-3.013** (1.361)	-2.341** (1.073)	-3.013** (1.361)
Temperature*IPV	0.096** (0.043)	0.067** (0.030)	3.029** (1.361)
List A is used	-0.024 (0.020)	-0.030 (0.021)	-0.024 (0.020)
Assigned to group 1	-0.056 (0.049)	-0.059 (0.048)	-0.056 (0.049)
Constant	2.452*** (0.692)	2.041*** (0.560)	2.452*** (0.692)
Observations	7,582	7,582	7,582

Note: .01 - ***; .05 - **; .1 - *;

Summary and Implications

- The Current level of climate change is causing a wide range of challenges.
- Costs and damages expected to rise rapidly with warming.
- Poly–crises (food insecurity, conflict, climate change, population growth. . .)
- Climate change related crises worsen inequality: Stronger impacts on the poor and vulnerable (gender, age, wealth)
- Non-economic impacts receive less attention (e.g. mental health, IPV)
- Less costly adaption mechanisms are available (e.g. cool roof)

Thank You!

References



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Global warming has increased global economic inequality.

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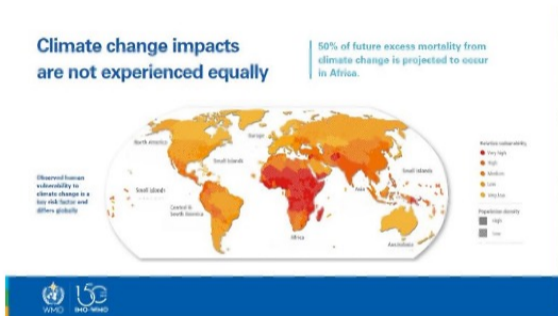


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Heterogeneous impact of climate change



Diffenbaugh, N. S., & Burke, M. (2019). Global warming has increased global economic inequality. *Proceedings of the National Academy of Sciences*, 116(20), 9808-9813.

Figure: climate change impact

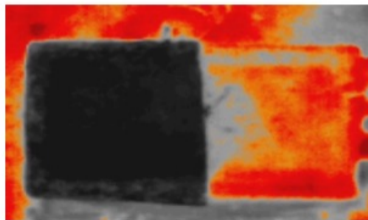
Application of cool roof



Application of cool roof coating



Coated (left) Vs. uncoated (right) roof



Thermal image of coated (left) Vs. uncoated roof

Design - cRCT

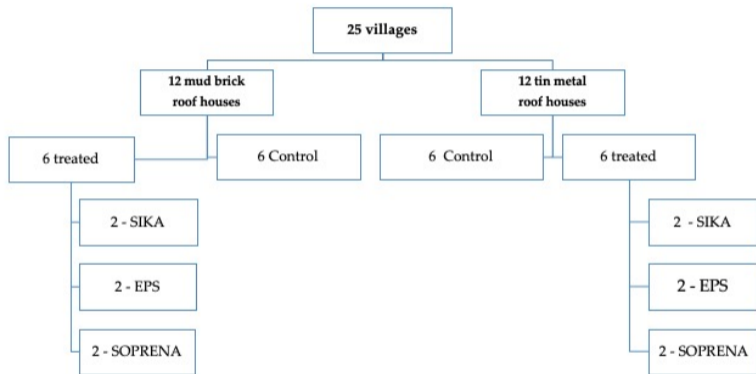


Fig4

